TESTING METHOD OF ARRAY CONFIGURATION FOR MULTIPLE DISK-ARRAY SYSTEM

Background of the invention

1. Field of the invention

The present invention relates to an array configuration testing method for managing disk drive in disk array, more particularly to an array configuration testing method cross-testing the serial check sum of each disk drive in the same array and the quantity of disk drives in the array as well as disk sequence/function record in order to check data integrity in the array configuration.

2. Description of related art

The rapid market growth of information products has urged the development of new technologies and new specifications in information industry. As to data storage device, the data transfer rate and data safety are important issues. Therefore, RAID (redundant array of independent disk drive) is proposed to meet above demands. RAID 0 (Redundant Arrays of Inexpensive Disks level 0) array provides the function of data striping to boost the data access speed. RAID 1 array provides the function of data mirroring to ensure security and safety of data storage and system stability. In addition, RAID 0+1 array, a combination of RAID 0 array plus RAID 1 array, has advantages in both data transfer speed and data security.

Fig. 1 shows the schematic diagram of a multiple disk-array system. The multiple disk-array system comprises a computer 32 connected to a plurality of disk arrays of various types and a plurality of independent disk drives 191 and 193 in a span array through an interface card 14. The plurality of disk arrays includes a first disk array 16, a second disk array 17 and a third disk array 18.

The first disk array 16 is a RAID 0 array which includes a first stripe disk drive 161 and a second stripe disk drive 163. The second disk drive array 17 is a RAID 0+1 array, which comprises a first stripe disk drive 171, a second stripe disk drive 173, a first mirror disk drive 175, and a second mirror disk drive 177. The third disk drive array 18 is a RAID 1 array, which comprises a source disk drive 181, a mirror disk drive 183, and a spare disk drive 185.

To access data in the disk drives of the disk arrays or the span array, the computer 12 firstly finds an accessing address of the data in corresponding disk

drive, and then accesses the disk drives of the disk arrays or the span array through the adaptor card 14.

Dealing with such an enormous architecture, correctness of array configuration will be very important; a minute mistake will cause serious damage to the whole system.

Summary of the invention

It is an object of the invention to provide an array configuration testing method for multiple disk-array system to provide more efficient testing for disk array.

In one aspect of the invention, the method cross-examines the disk information and the array information recorded in the array configuration to check data integrity in the array configuration.

In another aspect of the invention, the method checks the quantity of disk drives recorded in the array configuration with the quantity of disk drives deduced from the serial check sum of each disk drive in the same array.

In still another aspect of the invention, the method checks the disk sequence by the disk sequence/function recorded in the array configuration with the disk sequence deduced from the serial check sum of each disk drive in the same array.

To achieve above object and aspect, the present invention provides an array configuration testing method for multiple disk-array system. The multiple disk-array system contains at least one disk array. Each array has at least one disk drive with an array configuration, wherein the array configuration comprises array quantity of disk drives, a disk sequence/function and serial check sum of every disk drive in the same disk array. The array configuration testing method comprises steps of: reading array configuration; acquiring a quantity of disk drives in the array; reading the serial check sum of all disk drives in the array; and comparing the quantity of disk drives in the array and another quantity of disk drives deduced from the serial check sum of all disk drives in the array.

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comprises array quantity of disk drives, a disk sequence/function and serial check sum of every disk drive in the same disk array. The serial check sums of the disk drives in the same disk array are arranged in an order according to a sequence and a function of the disk drives. The array configuration testing method comprises steps of: reading array configuration; acquiring the disk sequence/function of the array in the array configuration; reading the serial check sum of all disk drives in the array; and comparing the disk sequence/function in the array and another disk sequence/function deduced from the serial check sum of all disk drives in the array.

The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawing, in which:

Brief description of drawing:

Fig. 1 shows a schematic block diagram of a multiple disk-array system;

Fig. 2 shows the array configuration;

Fig. 3 shows the array information;

Fig. 4 shows the disk information;

Fig. 5 shows a flowchart according to a preferred embodiment of the present invention.

Detailed description of the invention

Figs. 2, 3, and 4 show the array configuration, the array information and the disk information according to the present invention, respectively.

In the array configuration testing method according to the present invention, the array data and the disk drive data in the array configuration are cross-examined to check the correctness of array configuration. The array configuration comprises at least array quantity of disk drives, a disk sequence/function and serial check sum of every disk drive in the same disk array. The serial check sums of the disk drives in the same disk array are arranged in an order according to the sequence and function of the disk drives.

As shown in Fig. 2, the array configuration mainly comprises an array signature, a version identification, an array information/disk information, serial check sum of every disk drive in the same disk array, and a serial check sum of the array configuration.

The array signature is stored in offset 0 position of the array configuration

with the data type of one word (16 bits). The version identification is stored in offset 2 position of the array configuration with the data type of one byte. The array information/disk information is stored in the offset 3 position of the array configuration with the data type of 15 bytes. The array information/disk information is used to record data and status of the disk array and the disk drives thereof.

The serial check sum of each disk drive in the same disk array is stored in offset 18, 22, 26, 30, 34, 38, 42, 46 position of the array configuration with the data type of DWORD (double word, 32bits). The serial check sum of each disk drive is obtained according to a numeration on the model number, serial number, and firmware revision number of the disk drive. The serial check sum of array configuration is stored in the offset 50 position of the array configuration with the data type of one byte, which is obtained according to operation on the entire array configuration to examine the correctness of the array configuration.

Fig. 3 and Fig. 4 respectively depict the array information of each disk array and the disk information of each disk drive in the array configuration in more detail.

In the array information, bits 0-2 denote the quantity of disk drives in one disk array, which can be directly expressed by numeric value or other record type according to various array types. In this preferred embodiment, the total quantity of disk drives is recorded for the RAID 0 array, the spare quantity of disk drives is recorded for the RAID 1 array, which can be used to estimate the total quantity of disk drives; the source stripe quantity of disk drives is recorded for the RAID 0+1 array, which can doubled to compute the total quantity of disk drives; the total quantity of disk drives is directly recorded for span array.

Bit 3 denotes an array broken flag, which is binary 1 to denote a normal disk array and is binary 0 to denote an abnormal disk array with removed or damaged disk. Bits 4-7 denote the array type, for example: RAID 0, RAID 1, ... , RAID 7 is denoted by numeric values from 0 to 7, whereas other special arrays such as span or RAID 0+1 is denoted by numeric values like 8 or 9.

Bits 8-10 denote the serial number of each array in the disk system and are used to quickly identify the arrays in an array system. Bits 11-14 denote the size of recoded data stripe and utilize different numeric values to indicate

different data units such as 4k, 8k, 16k, 32k, or 64k. The size of recoded data stripe should be recorded for RAID 0 or RAID 0+1 disk to prevent error. Bits 15-46 denote the available capacity of each disk drive in the disk array. Bits 47-63 are reserved bits for future use.

In disk information, bit 0 is a boot field for indicating bootable function. Bit 1 is an enhanced field. Bits 2-33 record the serial check sum of each disk drive.

Bits 34-38 denote the disk sequence/function for disk drive in the disk array. To be specific, in the RAID 0 or span array, it denotes the disk sequence in the array. In the RAID 1 array, bits 34-35 denote the disk drive being a source, mirror, or spare disk drive, and the bit 36 denotes the necessity for synchronization or not. In the RAID 0+1 array, bits 34-36 record the disk sequence in the stripe array; bit 37 denotes the location of the disk drive in the source stripe array or the mirror stripe array; the bit 38 denotes the necessity for synchronization or not. Moreover, bits 39-55 are reserved bits for future use.

Fig. 5 shows the flowchart of the disk drive managing method according to a preferred embodiment of the present invention. In a first step 501, the array information in the array configuration is read. The array type is identified to be RAID 0, RAID 1, RAID 0+1 or other in step 503. The numeric value for quantity of disk drives is read and the total quantity of disk drives in the array is counted according to known array type in step 505.

In a following step 507, from the array configuration, the number of serial check sum for disk drives in the array is compared with the total quantity of disk drives counted in step 505. If the two numbers are not matched, the array configuration is recognized to be incorrect in step 523. It means the array configuration needs modification. If the two numbers are matched, the array configuration passes first-stage testing and the disk information in the array configuration is read. Afterward, the disk sequence/function information are known by reading the disk sequence/function in the array configuration and the disk type information in step 511.

As mentioned above, the serial check sums of the disk drives in the same disk array are arranged in an order according to the sequence and function of the disk drives. The disk sequence/function information obtained in step 511 is compared with the disk sequence/function information deduced from the serial

check sums in step 513. If these two information are not matched, the array configuration is recognized to be incorrect in step 523. If these two information are matched, the array configuration is recognized to be correct and to have normal function in step 515.

To sum up, array configuration testing method according to the present invention cross-examines the serial check sum of each disk drive in the same array and the quantity of disk drives in the array as well as disk sequence/function record. The data integrity in the array configuration can be efficiently checked.

Although the present invention has been described with reference to the preferred embodiment thereof, it will be understood that the invention is not limited to the details thereof. Various substitutions and modifications have suggested in the foregoing description, and other will occur to those of ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.